

REMARKS

Claims 16-29 are pending in the application. Applicant previously requested in the Response to the November 19, 2002 Office Action as well as in the Response to the July 30, 2002 Office Action that the examiner provide copies of various Forms-1449 that are not properly initialed by the examiner to indicate that the art was considered. Specifically, in an IDS filed January 15, 2002, page 1 of the accompany Form PTO-1449 lists under Other References as item AR an article by A.W. Ott, et al.

The Office has now twice provided a copy of the Form PTO-1449 with the examiner's initials indicating consideration of all the references except for the A.W. Ott article. Applicant has repeatedly requested that the Office consider the A.W. Ott article. The Office has never provided any explanation as to why the Office persists in refusing to initial the cited reference as considered. Applicant would be pleased to provide a copy of the article if it is missing from the Office's file. Applicant respectfully requests that the Office contact the undersigned upon receipt of the present Response to explain the action that the Office intends to take regarding this matter. Applicant desires to finally resolve with the Office that the A.W. Ott article will be considered.

In addition, the Office previously provided Applicant with a copy of a Form PTO-1449 filed on May 8, 2002 with an IDS. However, none of the references listed on the PTO-1449 were initialed to indicate they were considered. Applicant previously requested in the Response to November 19, 2002 Office Action that the Office consider the references and return a properly initialed Form PTO-1449 indicating such consideration. However, no such initialed copy was received with the present Office Action. Applicant once again requests consideration of the references and return of a

copy indicating consideration of such references. Applicant also requests that the Office contact the undersigned upon receipt of the present Response to indicate the course of action that the Office intends to take so that Applicant can be assured this matter will be finally settled.

The title of the invention is objected to as not descriptive. Page 2 of the Office Action suggests amendment of the title to read "Capacitor Construction With Enhanced Surface Area Having Both Inner and Outer Surface Per Unit Area Greater Than Outer Surface Per Unit Area Of Substrate." However, Applicant asserts that the suggested title is misdescriptive at least of claims 22-29. Apparently, the Office's suggestion for the title is based upon claim 16. While the suggested title might be descriptive of claim 16, claims 22-29 are also pending in the application and the suggested title does not properly describe the inventions set forth in claims 22-29. Specifically, the suggested title indicates that certain features are included in the invention when such features are not set forth as limitations in claims 22-29.

The Office previously requested amendment of the title and Applicant amended the title to read "Capacitor Construction With Enhanced Surface Area." The current title, as amended previously, is descriptive of all of the pending claims and clearly indicates the invention to which each of the claims is directed. The title suggested on page 2 of the Office Action only applies to claim 16 and, accordingly, and does not clearly indicate the invention to which claims 22-29 are directed. Applicant requests withdrawal of the objection to the title in the next Office Action.

Claims 16 and 17 stand rejected under 35 U.S.C. §102(e) as being anticipated by Agarwal. Applicant requests reconsideration.

Claim 16 sets forth a capacitor construction that includes a surface area enhancement layer over a substrate, a first capacitor electrode over the enhancement layer, a capacitor dielectric layer over the first electrode, and a second capacitor electrode over the dielectric layer. The first electrode has an inner surface area per unit area and an outer surface area per unit area that are both greater than an outer surface area per unit area of the substrate. Also, the first electrode does not comprise the enhancement layer. Pages 2-3 of the Office Action allege that Agarwal discloses each and every element of claim 16. However, Applicant asserts that Agarwal fails to disclose a first electrode that does not comprise the enhancement layer. Also, Agarwal fails to disclose a first electrode with an inner surface area per unit area and an outer surface area per unit area that are both greater than an outer surface area per unit area of the substrate.

Pages 2-3 of the Office Action allege that roughened ruthenium layer 16 of Agarwal along with layer 22 disclose the claimed enhancement layer in the embodiments of Figs. 4-7. However, in all of the embodiments of Figs. 4-7 as well as all other embodiments described in Agarwal, layer 16 forms part of an electrode of a capacitor. Specifically, paragraph [0047] of Agarwal states in lines 4-6 that layer 16 constitutes part of an enhanced-surface-area electrically conductive layer 26. Paragraph [0048] states that layer 26 shown in Figs. 3-6 is used to form a capacitor. Paragraph [0049], lines 11-14 state that conductive layer 26 forms one of the plates (or electrodes) of a capacitor.

Pages 2-3 of the Office Action make the erroneous attempt to distinguish layer 16 from layer 26 and state that layer 26 is formed over layer 16. However, it is clear

from paragraphs [0045] to [0049] that every embodiment described in Agarwal includes layer 16 as a part of layer 26. Layer 26 as a capacitor plate is thus expressly taught by Agarwal to include layer 16 as a part of the capacitor plate. At least for such reason, it is impossible for Agarwal to somehow disclose the claim 16 limitation that the first electrode does not include the enhancement layer.

Page 3 of the Office Action further alleges that layer 26 of Agarwal discloses the claimed first capacitor electrode with an inner surface area per unit area and an outer surface area per unit area that are both greater than an outer surface area per unit area of the substrate. However, such allegation is not supported with reference to any structures in Agarwal that disclose the claimed limitation. With regard to layer 26, every embodiment described in Agarwal shows layer 26 with an inner surface area that is flat and formed on an underlying flat substrate. Accordingly, the inner surface area per unit area of layer 26 is identical to the outer surface per unit area of the underlying substrate. Layer 26 thus does not disclose the claimed first capacitor electrode.

Applicant further asserts that no other structure exists within Agarwal that can possibly be considered to disclose the claimed first capacitor electrode. Even layer 24 of electrically conductive material shown in Fig. 5 does not disclose the claimed first capacitor electrode. Every embodiment of Agarwal shows layer 24 and layer 16 as both being conductive. All of the materials suggested by Agarwal for use in layer 16 are known by those of ordinary skill as conductive material. Accordingly, Agarwal always describes layer 24 as part of an electrode that includes layer 16.

Anticipation requires disclosure of each and every claim limitation. Agarwal fails to disclose the surface area properties of the claimed first capacitor electrode. Agarwal

also fails to disclose a first electrode that does not include the claimed enhancement layer. At least for such reasons, Agarwal does not anticipate claim 16. Claim 17 depends from claim 16 and is not anticipated at least for such reason as well as for the additional limitations of such claim not disclosed. Applicant requests allowance of claims 16 and 17 in the next Office Action.

Claims 22 and 24-26 stand rejected under 35 U.S.C. §102(b) as being anticipated by Fukuzumi. Applicant requests reconsideration.

Claim 22 sets forth a capacitor construction that includes, among other features, an opening in an insulative layer over a substrate, a hemispherical grain polysilicon layer over the sides of the opening but not over the bottom, a conformal first capacitor electrode on the polysilicon, a capacitor dielectric layer on the first electrode, and a second capacitor electrode over the dielectric layer. The first electrode is sufficiently thin that the first electrode has a rugged outer surface with an outer surface area per unit area greater than an outer surface area per unit area of the substrate underlying the first electrode. Page 3 of the Office Action alleges that Fukuzumi discloses each and every element of claim 22. However, Applicant asserts that Fukuzumi fails to disclose any capacitor construction that includes each of the claim limitations.

Referring to Figs. 18-20 of Fukuzumi, page 3 of the Office Action indicates that the corresponding text in the specification in Agarwal is paragraphs [0108] to [0111] and, referring to Fig. 22, that the corresponding text is paragraphs [0112] to [0113]. Applicant assumes that the Office intended to reference column 11, line 41 to column 12, line 16 instead. Page 3 of the Office Action alleges that the referenced portions of Fukuzumi disclose the claimed opening in an insulative layer over a substrate and a

hemispherical grain polysilicon layer over the sides of the opening but not over the bottom. However, the capacitor constructions shown in Figs. 18-20 do not disclose and are not alleged to disclose the claimed first capacitor electrode, capacitor dielectric layer, and second capacitor electrode. Anticipation requires disclosure of each and every element. However, neither Fig. 18 nor Fig. 19 nor Fig. 20 disclose each and every element of claim 22.

Page 3 of the Office Action also alleges that Fig. 22 of Fukuzumi discloses the claimed opening in an insulative layer over a substrate, hemispherical grain polysilicon layer, and first capacitor electrode. However, Fig. 22 does not disclose and is not alleged to disclose the claimed capacitor dielectric layer and second capacitor electrode. Accordingly, Fig. 22 also fails to disclose every element of claim 22.

Applicant acknowledges that lines 11-16 of the relied upon text in column 12 of Agarwal describe that Fig. 24 shows a capacitor structure that includes a dielectric film 16 and an upper electrode 27. However, Fig. 24 does not disclose an opening in an insulative layer over a substrate. Fig. 24 also does not disclose a hemispherical grain polysilicon layer over the sides of the opening but not over the bottom. Fig. 24 further does not disclose a conformal first capacitor electrode on the polysilicon. Accordingly, Fig. 24 fails to disclose each and every limitation of claim 22.

Given the deficiencies in Figs. 18-24 and the text associated therewith in disclosing any capacitor construction that includes every claimed limitation, Fukuzumi cannot be considered to anticipate claim 22. A thorough review of the relied upon portions of Fukuzumi as well as the remaining figures and text reveals that Fukuzumi does not disclose any capacitor construction that includes the claimed opening in an

insulative layer, polysilicon layer, first capacitor electrode, dielectric layer, and second capacitor electrode. In order to anticipate claim 22, Fukuzumi must disclose a capacitor construction that includes each and every limitation of claim 22. No such capacitor construction exists in Fukuzumi. At least for such reason, Fukuzumi does not anticipate claim 22. Claims 24-26 depend from claim 22 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed. Applicant requests allowance of claims 22 and 24-26 in the next Office Action.

Claims 27-29 stand rejected under 35 U.S.C. §102(b) as being anticipated by Fukuzumi. Applicant requests reconsideration.

Claim 27 sets forth a capacitor construction that includes, among other features, a surface area enhancement layer containing undoped polysilicon over a substrate, a first capacitor electrode on and in direct contact with the enhancement layer, a capacitor dielectric layer over the first electrode, and a second capacitor electrode over the dielectric layer. The enhancement layer has an outer surface area per unit area that is greater than an inner surface area per unit area of the enhancement layer. The first capacitor electrode does not contain the enhancement layer as part of the first electrode. Also, the first electrode has an inner surface area per unit area and an outer surface area per unit area that are both greater than the inner surface area per unit area of the enhancement layer. Page 4 of the Office Action alleges that Fukuzumi discloses every limitation of claim 27. However, Applicant asserts that Fukuzumi fails to disclose an enhancement layer containing undoped rugged polysilicon. Fukuzumi also fails to disclose a first capacitor electrode that does not include the enhancement layer as part of the first electrode.

Page 4 of the Office Action relies upon Figs. 30-34 corresponding to paragraphs [0135] to [0137] of Fukuzumi. Applicant assumes that the Office intended to reference column 14, line 54 to column 15, line 21 of Fukuzumi instead. The Office Action alleges that polysilicon film 51 of Fukuzumi discloses the claimed enhancement layer containing undoped rugged polysilicon. The Office Action also alleges that metal film 52 discloses the claimed first capacitor electrode that does not include the enhancement layer as part of the first electrode. However, by making such allegations, the Office asserts an interpretation of the capacitor construction in Fukuzumi that renders such construction inoperable. Column 14, lines 62-65 expressly state that polysilicon film 51 "forms part of the lower electrode of a capacitor." At least for reason, Fukuzumi fails to disclose the claimed first capacitor electrode that does not include the enhancement layer as part of the first electrode.

In addition, those of ordinary skill readily recognize that polysilicon film 51 must form part of the lower electrode. Since metal film 52 does not directly contact the contact plug 3 that connects the element region of the underlying semiconductor substrate to the capacitor, polysilicon film 51 must provide the conductive connection between metal film 51 and contact plug 3. In this manner, the lower electrode formed by metal film 52 is connected to the element region of the semiconductor substrate and may function as intended. If, instead, polysilicon film 51 is undoped or otherwise does not form a part of the lower electrode in Fukuzumi, then the resulting capacitor cannot function properly.

Page 4 of the Office Action alleges that Fukuzumi discloses polysilicon film 51 being undoped. However, no express disclosure of such a feature exists within

Fukuzumi. Instead, the Office appears merely to assume that polysilicon film 51 is undoped. However, as indicated, polysilicon film must be doped sufficiently to form a conductive connection between contact plug 3 and metal film 52. At least for such reason, Fukuzumi cannot be considered to disclose the claimed enhancement layer containing undoped rugged polysilicon.

At least for the reasons indicated, Fukuzumi fails to disclose the enhancement layer set forth in claim 27. Fukuzumi also fails to disclose the claimed first capacitor electrode. Fukuzumi thus does not anticipate claim 27.

Claim 28 sets forth a capacitor construction that includes, among other features, an opening having sides and a bottom in an insulative layer, a HSG polysilicon layer over the sides of the opening but not over the bottom, a conformal first capacitor electrode on the HSG polysilicon layer, a capacitor dielectric layer on the first electrode, and a second capacitor electrode over the dielectric layer. The first capacitor electrode does not include the HSG polysilicon layer as part of the first electrode. Also, the first electrode is sufficiently thin that the first electrode has a rugged outer surface with an outer surface area per unit area greater than a surface area per unit area of the sides of the opening over which the HSG polysilicon layer is formed. Pages 4-5 of the Office Action allege that Fukuzumi discloses every limitation of claim 28. However, Applicant asserts that Fukuzumi fails to disclose any capacitor construction that includes all of the limitations set forth in claim 28.

As may be appreciated from the above discussion regarding the deficiencies of Fukuzumi as applied to claim 22, Figs. 18-20 relied upon by the Office fail to disclose the claimed first capacitor electrode, capacitor dielectric layer, and second capacitor

electrode. No capacitor electrodes or dielectric layers are disclosed in any of Figs. 18-20 or the text associated therewith. Similarly, Fig. 22 of Fukuzumi fails to disclose the claimed capacitor dielectric layer and second capacitor electrode. Further, Fig. 24 of Fukuzumi fails to disclose the claimed opening in an insulative layer, HSG polysilicon layer, and conformal first capacitor electrode on the HSG polysilicon layer that does not including the HSG polysilicon layer as part of the first electrode. Anticipation of claim 28 requires that Fukuzumi disclose a capacitor construction that includes each and every limitation as set forth in claim 28. Since it is well established that Fukuzumi fails in this regard, Fukuzumi does not anticipate claim 28.

Claim 29 depends from claim 28 and is not anticipated at least for such reason as well as for the additional limitations of such claim not disclosed. Fukuzumi does not anticipate claims 27-29 and Applicant requests allowance of such claims in the next Office Action.


Claims 18-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Agarwal in view of Fukuzumi and further view of Rhodes. Claim 23 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Fukuzumi in view of Rhodes. Applicant requests reconsideration. Applicant notes that both Agarwal and Rhodes qualify as prior art only under one or more subsections (e), (f), and (g) of 35 U.S.C. 102. The subject matter of Agarwal and Rhodes and of claims 18-21 and 23 were at the time the invention was made owned by Micron Technology, Inc. or subject to an obligation of assignment to Micron Technology, Inc. as evidenced by recorded assignments pertaining to the present application and to Agarwal and Rhodes. According to 35 U.S.C. 103(c), Agarwal and Rhodes cannot preclude patentability

under section 103. Thus, Applicant requests withdrawal of the rejection and allowance of claim 18-21 and 23 in the next Office Action.

Applicant herein establishes adequate reasons supporting patentability of claims 16-29 and requests allowance of all such pending claims in the next Office Action.

Respectfully submitted,

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